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Maximizing the Full Economic Potentials of Ikere Gorge and Oyan Dams for National Economic Development

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A study was carried out to review the works of different researchers on Ikere gorge dam and Oyan dam; the two main multipurpose dams in the southwest Nigeria under the control of Ogun Osun River Basin Development Authority. The two gigantic dams and other smaller dams in the area were found to be grossly under- utilized considering the water storage capacity and purposes for which the dams were built. The dams were meant to serve the people in the region in terms of water provision, irrigation farming, hydro power generation, fishery, recreation, navigation and other purposes. The economic potential of the two engineering water infrastructures were highlighted. An appeal is now being made to the relevant authorities through this medium to explore areas of utilizing the two dams for regional and national economic development.

Key words: Economic potential, national development, Dam, Gorge dam.

INTRODUCTION

Soil and water conservation engineering is the application of engineering knowledge in the conception, planning, design, construction and operation of facilities and structures or infrastructures related to the judicious utilization of the limited water available on earth and the sustainable use of lands as a natural resource. Soil and water are the basic resources in Agriculture. Water is a basic necessity to man, animal and plant. If water is properly harnessed and utilized it can bring an immense benefits and on the other hand untold hardship to man if not properly managed.

A dam is a structure built across a stream or river for impounding water and to create reservoir or lake on its upstream side. The stored water is used for various purposes, such as Irrigation, rural and municipal water supply, industrial water supply, hydropower, recreation and navigation. A gorge dam is one that is built in between two hills which is a cleft with steep, rocky walls, especially one through which a stream or river runs (Iloeje, 2001)) Presently, Nigeria has over 300 dams (Ogheide, 2002). In 1973, Nigeria was divided into 11 River Basin (RB) areas each under the Federal Ministry of Water Resources. The functions of these RBs include among others, the provision of potable water to many communities and the development of surface and ground water resources of their coverage area. Bakolori dam for example falls under the Sokoto-Rima Basin Development Authority in Northern Nigeria. The Tiga Dam, Challawa Gorge Dam and the Kafin Zaki Dam are located in the Hadejia – Jama'are River Basin in Northern -Nigeria (Figure 1) while the Kainji, Jebba and Shiroro are found in the Niger Basin. Others that fall under Ogun-Osun River Basin in the South west include Asejire, Eleyele, Erinle, Oyan, Ikere-Gorge, Egbe, Ero, Erelu and Ejigbo. Success stories of dams in Nigeria include the generation of electricity mainly

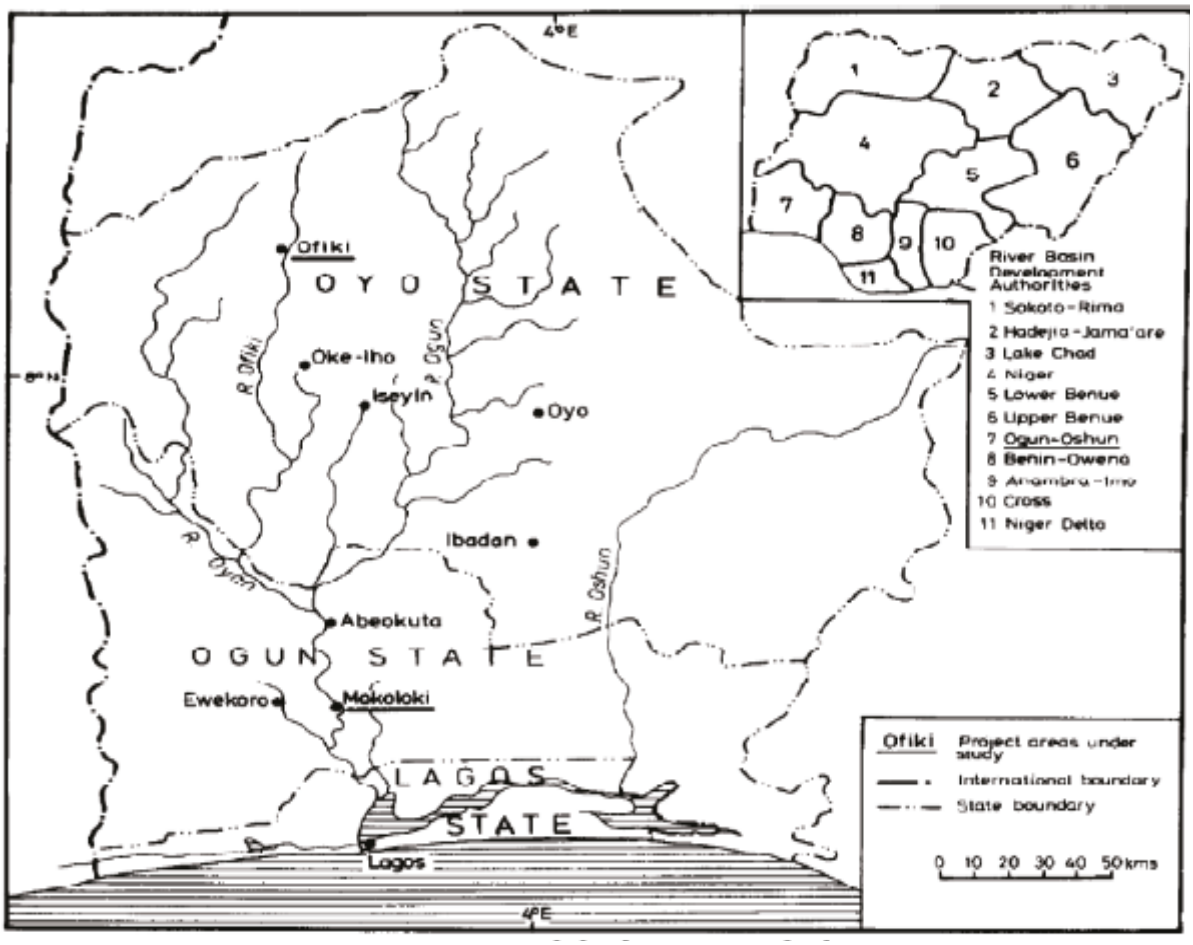

Figure 1. Ogun-Osun River Basin and the locations of other River Basins in Nigeria (FAO, 2005).

Kainji, Jebba and Shiroro. Kainji was designed to have a power generating capacity of 960 MegaWatts (Awomeso et al., 2009).

Another success story of dams in Nigeria is the increase in food production and hence poverty alleviation through irrigated agriculture and fisheries. The Bakolori dam has a design capacity to irrigate 35,000 ha of farmland, Kafin-zaki dam 125,000 ha, challawa 40,000 ha and Tiga 20,000 ha (Enplan, 2004). Dams have equally done so much ecological and human damages in Nigeria in the last decade. Several lives have been lost, thousands of people displaced and several villages destroyed due to dam failures and urgent release of excess water from the dam reservoir to forestall dam failure.

Overview of water resources of Nigeria

Nigeria has abundant water resources although they are unevenly distributed over the country. Nigeria is well drained with a close network of rivers and streams from North to South, East to West and Central Nigeria. Some are perennial while some are ephemeral especially those streams that are found in the North. There are four principal surface water basins in Nigeria namely: Niger Basin has an area of 584,193 km^2 within the country. It constitutes 63% of the total area of the country and covers a large area in Central and North-west Nigeria. The key rivers in the basin are the Niger and its tributaries Benue, Sokoto Rima, Katsina-Ala, Donga, Taraba and Kaduna.

Lake Chad Basin in the Northeast has an area of 179, 282 km^2 or 20% of the total area of the country. It is the only internal drainage basin in Nigeria. Important rivers here are the Komadougou Yobe and its tributaries Hadejia, Jama'are and Komadougou Gena. The South-Western littoral basins have an area of 101,802 km^2, which is 11% of the total area of the country. The South-Eastern littoral basins, with the major watercourses being the Cross and Imo rivers, Qua Iboe and kwa River, have an area of 58,493 km2, which is 6% of the total area of the country. They receive much of their runoff from the plateau and mountain areas along the Cameroon border (FAO, 2010). Apart from the lake chad drainage system, the remaining three

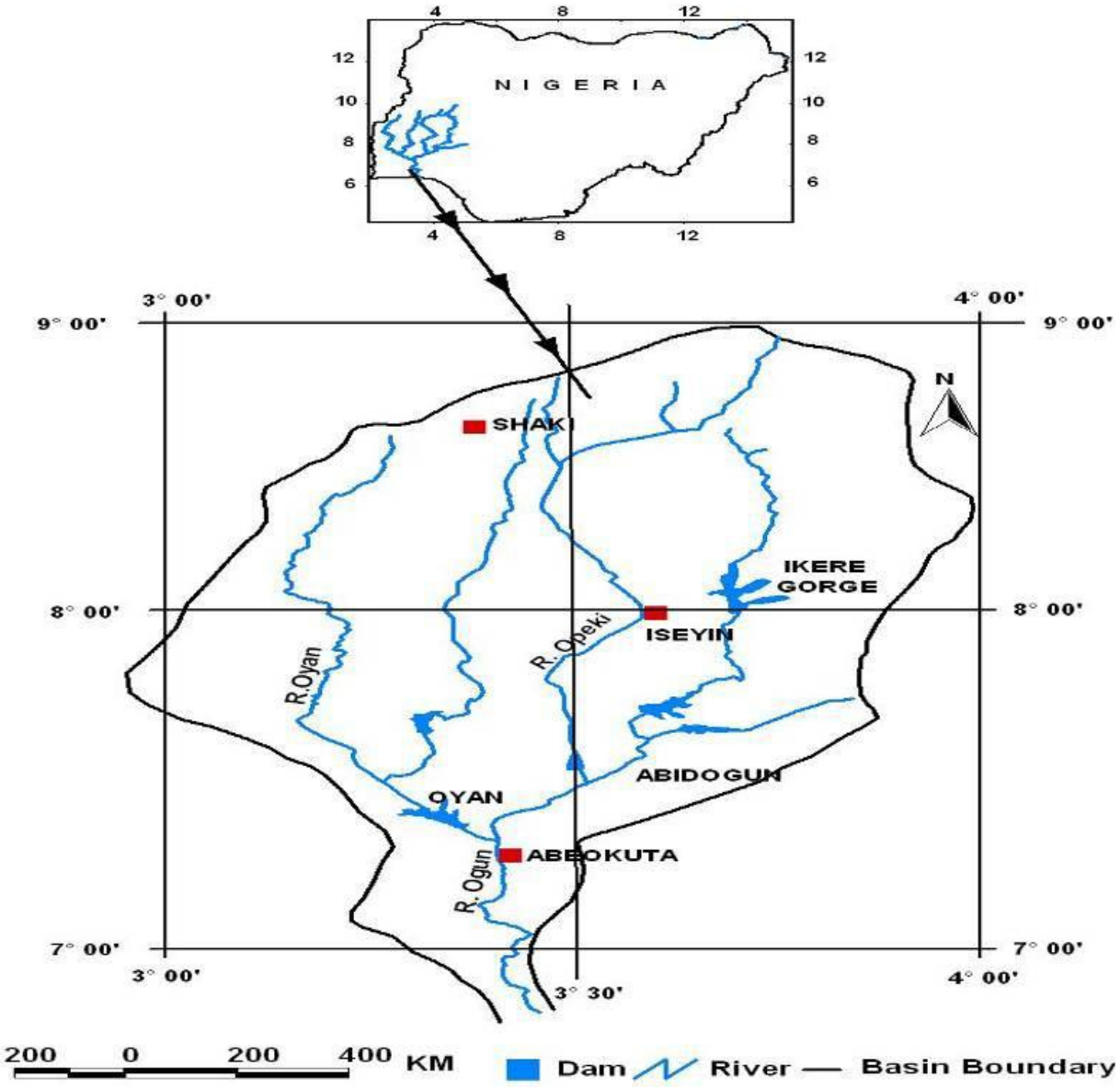

Figure 2: The Ogun River Drainage Basin **(**Source: OORBDA, 1998).

drainage systems terminated in the Atlantic Ocean with an extensive network of Delta channels.

In Nigeria, water resources management at basin scale is vested into the River Basin Authority. Currently, there are twelve river basin authorities established for the purpose of managing water use and allocation (FAO, 2005). These are:

1. Sokoto-Rima River Basin Development Authority;
2. Hadejia Jama're River Basin Development Authority;
3. Chad Basin Development Authority;
4. Upper Benue River Basin Development Authority;
5. Lower Benue River Basin Development Authority;
6. Cross River Basin Development Authority;
7. Anambra / Imo River Basin Development Authority;
8. Upper Niger River Niger Basin Development Authority;
9. Lower River Niger Basin Development Authority;
10. Ogun-Osun River Basin Development Authority;
11. Benin-Owena River Basin Development Authority;
12. Niger Delta Basin Development Authority.

MATERIALS AND METHODS

A site visit was made to the two multipurpose dam sites in the river basin at different times in 2010 and 2014. The desk work and study of the relevant documents obtained from Ogun Osun River Basin headquarters in Abeokuta was also done. Oyan dam reservoir and ikere dam reservoir were visited and the river system downstream of the two dams were explored and studied. Farmers and residents of the dam area were

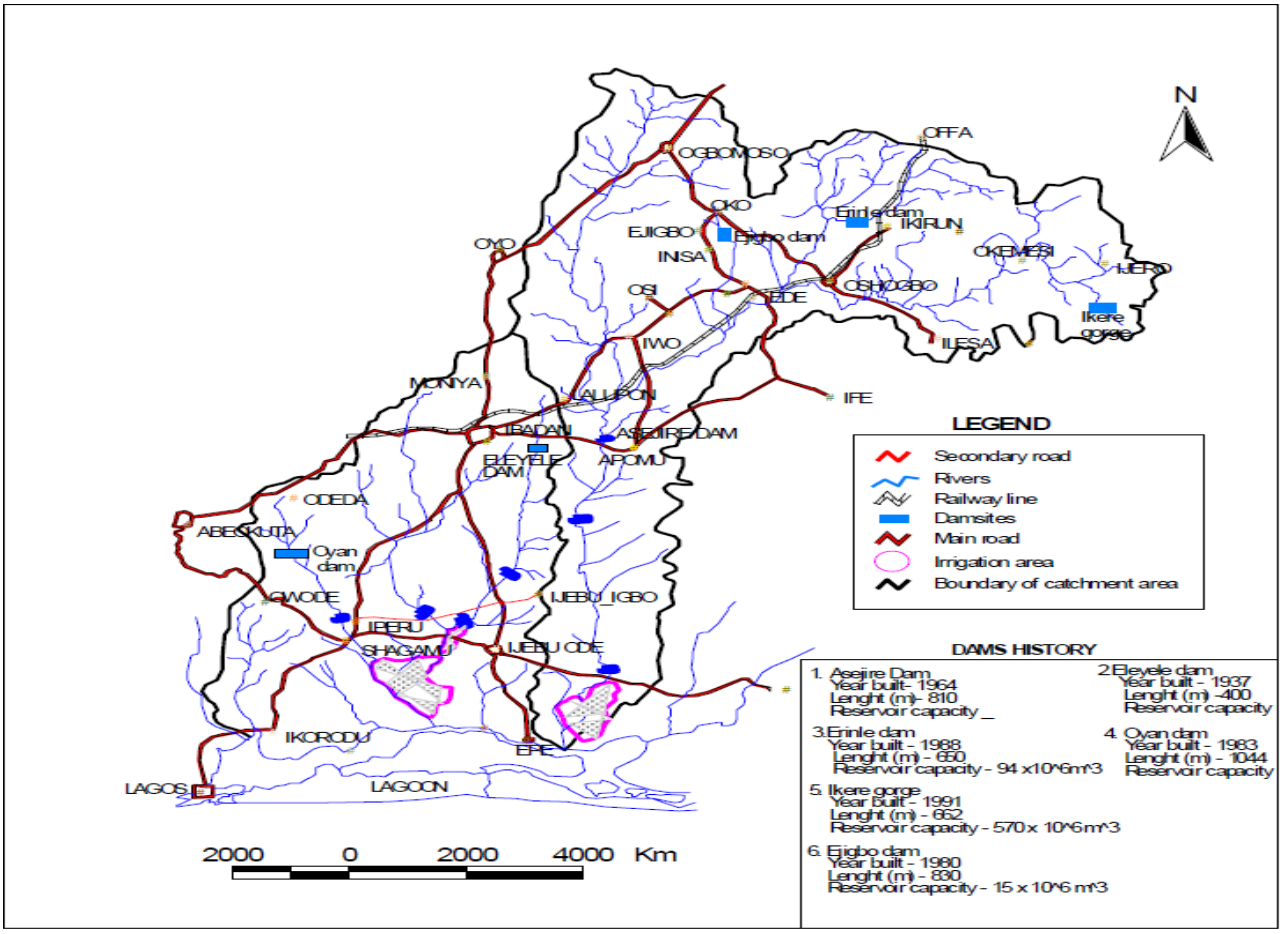

Figure 3. Ogun–Osun River showing some dam locations in the South-Western part of Nigeria (Source: Awomeso et al., 2009).

interviewed and interacted with to obtain information on what living around the multipurpose dam look like.

Description of the study areas

Oyan dam

Oyan dam, owned and operated by the Ogun-Osun River Basin Development Authority (O-ORBDA) was commissioned on 29th March, 1983. The lake is located on latitude 7°15'N and longitude 3°16'E at an elevation of 43.3 m above sea level on the confluence of Oyan and Ofiki rivers, both tributaries of Ogun river some 20 kilometers North West of Abeokuta, close to Badagry-Sokoto Highway,

It has a catchment area of approximately 9,000km². The lake covers an area of 4,000 hectares. It was designed to supply 525 million liters and 175 million liters of raw water per day to the Water Corporations at Lagos and Abeokuta respectively. It was also designed to provide water for the irrigation of about 3,000 ha Lower Ogun Irrigation Project under construction. In addition, it has the capacity to generate 9 Megawatts of hydroelectric power for distribution to Abeokuta and its environs. The three turbines of 3.0 megawatts each have been installed since 1983 but have never been commissioned (put into use). The Authority also controls fishing activities on the reservoir. The authority established three settlement camps for the displaced (22) communities submerged by the resulting lake: one on each bank of the lake in Ogun State and the third on the far end of the lake in Oyo State which were named Ibaro, Abule Titun and Igbo-Ora respectively (OORBDA, 1998). In all the locations, a total of 211 houses comprising 25 three bedroom and 186 two bedroom houses were constructed and allocated to the resettlers. The study area receives a mean annual rainfall of 1015.09 mm. The highest rainfall of the area is recorded in June, July and September. The minimum rainfall is exhibited in December and January. Ogun River Drainage basin is shown in Figure 3 and the spillway is designated as Figure 5.

Ikere Gorge Dam

The dam is located in Iseyin Local Government, Oke

Figure 4. The water release outlet for Ikere gorge Dam.

Figure 5. The spillway section of Oyan dam (Source: Olatunji, 2013).

Ogun region and has Owu reserve in its Northwestern part. It has the following descriptions: Earth fill embankment, Length of axis 660 meters Height at center 47.5 m, Volume of the earth fills 1.4 million cubic meters (MCM), Crest elevation 277.50 meters a.m.s.1. Physical specification: Capacity 265 MCM, Area 53 sq. km, Maximum water level 273.5 meters a.m.s.1 (above minimum sea level), Normal water lever 266 meters a.m.s.1 (OORBDA, 1998) The reasons for sitting the dam where it is, according to Ogun Osun River Basin Development Authority (O-ORBDA) are to:

1. Provide water supply to Iseyin, Okeho, Iganna, and the neighbouring towns.
2. Provide irrigation water for 3,000 Ha of arable farm land tagged middle Ogun irrigation project.
3. Generate 6 megawatts of hydroelectricity.
4. Supply 82 million cubic meters (mcm) raw water through the spill way to Lagos metropolis.

5. Produce 17,325 tons of maize, 954 tons of Sorghum and 3,630 tons of cassava tubers annually.

Assessment of the works on the dam presently according to O-ORBDA (1998) shows that the civil works are 99.5% completed. Mechanical and electrical works are 90% completed (excluding the hydropower components). Investigations revealed that thirteen (13) villages were displaced and resettled with no social or political unrest and dissatisfaction associated with relocation of villages. The water release outlet for ikere gorge dam is shown in Figure 4.

The role of agriculture in Nigerian economy

Before Nigeria attained independence, agriculture was the most important sector of the economy, and accounted for more than 50% of GDP and more than 75% of export earnings. Consequently, with the rapid expansion of the petroleum industry, agricultural development was neglected, and the sector entered a relative decline. Thus, between the late seventies and late-eighties, Nigeria moved from a position of self-sufficiency in basic foodstuffs to one of heavy dependence on imports. Under-investment, a steady drift away from the land(rural) to urban areas (cities), increased consumer preference for imported foodstuffs (particularly rice and wheat) and outdated farming techniques continued to keep the level of food production well behind the rate of population growth.

Ogun - Osun River Basin Development Authority

Ogun-Osun River Basin is located in the South Western part of Nigeria, latitudes 8^{o} 20'N and 6^{o} 30' N and longitudes 5^{o} 10' W and 3^{o} 25' W (Figure 2) with a land area of 101,802 km^2, which is 11% of the total area of the country. Land cultivation and farming activities are carried out in almost all parts of the basin and this led to the establishment of farm settlement schemes in strategic locations within the basin. Food and cash crops such as Cocoa, Kola, Palm trees, Plantain, Maize, Yam, Cocoyam, etc. are planted in the basin. The river basin covers the present Lagos, Ogun, Osun, Oyo and parts of Kwara states of Nigeria (Adeboye, 2015).

The creation of the River Basin and Rural Development Authorities (RBRDA) in Nigeria was motivated by the desire of the Federal Government to facilitate and accelerate food production to cater for the demands of the teeming population and to open up rural settlements throughout the country for increased food production (NINCID, 1999).

Climate

Generally, the Ogun-Osun River Basin's climate is influenced by the movement of the inter-tropical convergence zone (ITCZ), a quasi-stationary boundary zone, which separates the sub-tropical continental air mass over the Sahara and the equatorial maritime air mass over the Atlantic Ocean. The former air mass is characterized by the dry North-Easterly winds called the Harmattan found in the rain-bearing South-Westerly winds from the Gulf of Guinea as reported by Adeboye (2015).

Rainfall and air temperature

The maximum and minimum relative humidity value is found in July (89.5%) and March (74.2%), respectively. In general the highest humidity values are found in the rainy months whereas the lowest values are in dry months. Seasonal distribution is the main feature of the rainfall pattern in Ogun-Osun River Basin. The rainy season emerges earlier in the South in March and continues until end of October or early November, with at least seven months of rainfall. In the north of Ogbomoso the rain starts in early May or late April and ends in the middle of October. Dry days are regular and sufficiently regular in late July and early August to constitute a 'little dry season' whose monthly precipitation depth is below 120 mm. In the wet season, the mean rainfall ranges between 1,020 and 1,520 mm in the south of the basin, but in the north, it is less than 1,020 mm. In the North and South, the mean dry season rainfall varies from 127 to 178 mm and 178 to 254 mm, respectively.

The record of temperature in the basin shows that the hottest months are February and March during which temperatures are high over the entire area. For the month of February, the mean daily maximum temperature is 32°C in the North. The minimum recorded temperature during harmattan in the North is 47°C. During the rainy season in July, a lowest mean minimum temperature of about 22.8^{o}C was recorded (OORBA, 1982).

Soil and land resources

Due to the erosion and sediment transport, the soils in the basin have developed into alluvial parent materials. The basement complex in the upper part of the basin gives rise to a wide variety of soils, coarse in texture and of low fertility. In Ogun-Osun River Basin intensive (row crops, minor grazing) smallholder rainfed agriculture dominates. Undisturbed forest is scanty because of the frequent lumbering activities in the basin over the years. For productive intensive crop production in the basin, irrigation and heavy fertilizer application is highly required. The soils in the basin are classified into two groups based on location and elevation (OORBA, 1982). These are the upland soils, which are more developed and range from heavy and hydromorphic to coarse and well-drained and the lowland soils, which are hydromorphic and affected by a high ground water table and seasonal flooding. Water resources in Ogun-Osun River Basin include surface water and groundwater. Surface water plays a prominent role in the basin. Due to the relative abundance of surface

water in the basin, groundwater seems not to be of significance for crop cultivation and consumption.

Current Challenges in Ogun - Osun River Basin

Inadequate funding, Poor management and lack of autonomy is the major challenges of OORBDA despite the available of sound technocrats and technical staff. The situation where the Managing Director is appointed from the Ministry of Water Resources headquarters in Abuja makes it difficult for the incoming head of administration to know what the long term agenda of the authority is. Water resources management is a long term management affairs. Whenever the Managing Director comes from within the staffer of the authority they direct the affair of the organization with sentiments. Equipment procured for land and water management such as sprinkler irrigation facilities are in a state of disrepair for long period. In few places where old sprinkler are being replaced with center pivot irrigation systems they are underutilized. Consequently, economic returns on that equipment have not justified the huge investment made on them years ago. Various schemes established to maximize the use of water for crop production in the basin have been either abandoned or not given appropriate attention by the agencies whose responsibility is to manage them effectively to attain regional and national sufficiency in crop production.

RESULTS AND DISCUSSION

Economic potential of Ikere Gorge dam and Oyan dam

A quick look at the technical specification of Ikere gorge dam and Oyan dam shows the following information about the dams (O-OBDA, 1998):

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Ikere Gorge Dam

1. It has a surface area of 47 km^2
2. Water storage capacity of 565 – 690 Million per Cubic Meter
3. HEP generation capacity of 6 MegaWatts
4. Capacity to irrigate 12,000 ha of land (Based on the then wasteful available irrigation methods)
5. Dam height of 51 meters, crest length 646 meters
6. Earth and Concrete dam, Purpose (Irrigation, Fishing and Water supply/ HEP)

Oyan Dam

1. It has a surface area of 40 km^2
2. Water storage capacity of 270 Million per Cubic Meter
3. HEP generation capacity of 9 MegaWatts
4. Capacity to irrigate 3,000 ha of land (Based on the then wasteful available irrigation methods)
5. Dam height of 32 meters, crest length 1.1 kilometers
6. Earth and Concrete dam, Purpose (Irrigation, Fishing and Water supply/ HEP)

Potential is an inherent attribute that is waiting to be tapped, utilized or developed. It is a nature of an object or being that is not visible to just anybody except a trained individual in an area relating to the study of the object or being. The two dams even though they are built for specific purposes need to be operational for the purposes to be attained

For now, these gigantic water engineering structures are just being used to impound water which is later released to the surrounding for no economic gains different from how it is done elsewhere in the world. As at now, not up to 4,000 ha of land is under irrigation in both Ikere and Oyan dam. A ridiculous 20Ha Center pivot Irrigation Equipment was installed in Ikere gorge dam (Figure 6) and another two (2) 7 Ha Center Pivot Irrigation Equipment is in Oyan Dam.

Ogun State is not deriving optimum benefits from Oyan dam and the lake created behind it. Rather, in recent years, water releases from the dam have been used to create destruction and disruption of livelihoods and economic life in communities downstream of the dam contrary to the operational principles adopted for the design and construction of the dam. The floods observed downstream of Oyan Dam in 2007, 2010 and 2011 took place during the months of August, September and October. It is evident that if power is being generated from Oyan Dam there would be no floods in places like Abeokuta close to the dam and in places downstream like Punchplace, Warewa, Riverview Estate, Opic Estate, Lonex Gardens, Riverbank Estate and Guinness Cooperative Estate which are places close to Lagos State and the Lagos Lagoon.

If only we can generate mini Hydro power from these dams we would have been able to save millions of naira spent on diesel generators used in powering opening and closing of outlet gates through which water is being released from the dam reservoir, and we would have provided cheaper energy for lifting water away from the dam area to adjacent lands and also for powering the agro-processing factories in places like Alobo and that will give value to the farm produce in the area.

Fishing in Ikere and Oyan dam is nothing to talk about. Daily fishing rate of less than 2 tonnes a day is often recorded. I remember the last time I visited the Dam site there was no fish to entertain our team who visited the site for Center Pivot Equipment Maintenance. For dams that have been impounding water for more than 2/3 decades and has a surface area of over 40km^2. There is enough fresh water for aquaculture all year round. We have always been hearing about middle Ogun and lower Ogun in the

Figure 6. The 20 ha (4 -span) Center pivot system installed at Ikere Gorge dam**.**

downstream of Ikere and Oyan dams respectively; they are not enough compare to the potential of the two hydraulic structures.

Recently, there was an advertorial from the Oyo State government on the rejection of the proposal by the Federal Ministry or Water Resources to give out Ikere gorge dam to an external investor. The question is what has the government of Oyo state been doing before now? or maybe because of the dwindling in the revenue accruable to the state that has prompted them to look inward now. We need to have functional infrastructure or may be Ogun Osun and other River Basins should stop awarding contracts for new dams for the next 2/3 years and concentrate on the full utilization of the existing ones rather than continue to build new dams that will not be fully utilized for wealth creation.

On ecotourism, Ikwenweive et al. (2007) investigated the suitability of Oyan Dam lake as tourist center from his work in 2001/2002 and reported that the lake is indeed a tourist destination if necessary infrastructure that support tourism is put in place in the dam area. Ikere has residential quarters which is designated as “European quarters and Man camp”. These are buildings overlooking the dam reservoir/lake and dam axis respectively. They provide pleasant view for tourists aside accommodation. It is also a cherishable venue for retreat, training of new staffer, camping and other recreational activities; the only challenge is the deplorable condition of the 28 km access road to Ikere gorge dam from iseyin.

Conclusion

The economic potential of both Ikere gorge dam and Oyan dam is enormous. It is high time the two host states within which the two multipurpose dams is located take responsible steps toward full maximization of the Economic potential of these engineering infrastructures in their domain. If at all the governments of these two states lack the technical capability of using these dams for the overall benefits of their people they can hire consultant or work with a private companies which is well experienced in managing any of the resources for the betterment of their states. This can be inform of a Public Private Partnership, Built Operate and Transfer if we still believe in the general saying that Government has no business in doing business. Above all, feasibility studies on other dams in the region should be undertaken to assess the possibility of turning them to wealth creation centers. In the case of Ikere Gorge dam, the quarters have been colonized by fishermen who have been earning their livelihood by engaging in fishing activities in the dam lake. Proper arrangement should be made to resettle them before the commencement of the total renovation of the entire dam

and residential Area.

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